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SOME OBSERVATIONS ON SOARING FLIGHT IN THE MOURNING CLOAK BUTTERFLY (*NYMPHALIS ANTIOPA* L.) IN SOUTHERN ONTARIO

David L. Gibo

Abstract.—The Mourning Cloak butterfly, *Nymphalis antiopa* L., is capable of soaring flight. The adults appear to recognise rising air currents and exhibit complex behaviour patterns to stay inside these systems. The soaring behaviour of *N. antiopa* is similar to that of monarch butterflies, *Danaus plexippus* L.

Soaring flight consists of maintaining or gaining altitude by gliding in rising air currents (Conway 1969; Gibo and Pallett 1979). Consequently, a soaring animal is actually remaining aloft by extracting energy from the atmosphere. Although soaring flight is the most efficient form of flight possible in terms of energy expenditure per unit of distance travelled (Pennycuick 1969), deliberate use of this flight technique has only been reported for two insects, the monarch butterfly, *Danaus plexippus* L. (Gibo 1981; Gibo and Pallett 1979; Schmidt-Koenig 1979), and the dragonfly *Pantala flavescens* Fabricius (Hankin 1921). The apparent rarity of this flight technique among insects may be due to the need for complex behaviour patterns (Gibo and Pallett 1979; Hankin 1921; Pennycuick 1969, 1972, 1975), special sensory systems (Johnson 1969), and specific meteorological conditions (OSTIV 1978). During a 9 day period in the late summer of 1979, while observing the flight of migrating monarch butterflies, *Danaus plexippus* L., in southern Ontario, I was also able to observe the flight techniques of mourning cloak butteries, *Nymphalis antiopa* L. Three of the 11 *N. antiopa* observed were soaring. This note is a preliminary report on the soaring behaviour of *N. antiopa*.

One observation was made in an open area on the Erindale College Campus of the University of Toronto and two were made in an open area 3 km to the west of the campus. The times ranged from noon to midafternoon. Wind velocities at 1 m above the ground were measured with a wind meter. The courses of the butterflies were determined with a compass. The air temperature at 1 m was also measured. The estimated altitude of the butterfly above the ground was recorded and any significant manoeuvers performed by the soaring butterflies, such as circling, were noted.

Two of the soaring *N. antiopa* were observed to enter thermals (rising bubbles or columns of relatively warm air produced by convection). The first individual, observed on 4 September at 12:03 P.M. (E.S.T.), flew overhead at an altitude of 20 m. The wind direction was 165° and the velocity

was 5 km/hr. Initially the butterfly employed powered flight and maintained a 225° (SW) course. Suddenly, presumably upon encountering a thermal, the butterfly stopped beating its wings and began soaring in circles 1 m in diameter. After gaining approximately 10 m in altitude and simultaneously drifting approximately 50 m downwind on a 325° (NW by W) track, the butterfly abruptly resumed powered flight and reestablished its former SW course.

The second individual, observed on 5 September, gave an impressive demonstration of its ability to locate and exploit a weak thermal. When the butterfly was first observed (11:45 P.M., E.S.T.), it was flying under power at a height of 1 m and was maintaining a SW course. There was no apparent wind within 2 m of the ground. As the *N. antiopa* passed over a paved parking area 5 m from the observation point it suddenly began to climb, still beating its wings, until it reached a height of 3 m. It then stopped beating its wings and began soaring in circles. The butterfly did not beat its wings again for the rest of the observation: a period of 2 minutes. Initially the butterfly flew in circles approximately 3 m in diameter remaining directly over the parking area. It gained altitude gradually and required about 1.5 m to reach a height of 15 m. Apparently there was a light northeast breeze at this height because the butterfly then began to drift on a 215° (SW by S) course, reducing the size of its circles to approximately 1 m in diameter. For the remainder of the observation the butterfly continued to soar in 1 m circles and drift on a 215° (SW by S) track. When the *N. antiopa* reached an approximate altitude of 25 m and a distance of 80 m, I could no longer determine whether it was still gliding (i.e. not beating its wings) and terminated the observation.

The third individual was observed on 8 September. The *N. antiopa* was already soaring overhead in a thermal when first noticed. The time was 2:38 P.M. (E.S.T.). The wind direction was 105°, and the velocity was 5 km/hr. This butterfly was at an altitude of 20 m and soared in circles of approximately 1 m in diameter while drifting overhead on a 285° (W by N) course. This last specimen neither gained nor lost altitude, but simply drifted downwind until it was lost from sight.

The mourning cloak has long been known to migrate in Europe (Williams 1942, 1958) and there is evidence that at least part of the population in eastern North America migrates (Shannon 1917). Frequent episodes of soaring would significantly reduce the energy expenditure of this activity. It is interesting to note that the mean course and angular deviation (see Batschelet 1965) of the 11 *N. antiopa* in this study was 246° ± 30.3 (WSW), which is similar to the SW to SSW courses frequently reported for migrating *D. plexippus* (Beall 1941; Schmidt-Koenig 1979; Urquhart 1960; Urquhart and Urquhart 1978).

The mourning cloak butterfly is the second butterfly found to exhibit

specialized soaring behaviour. The soaring behaviour observed for *N. antiopa* in thermals was similar to the behaviour reported by Gibo and Pallet (1979) for *D. plexippus*. Individuals of both species are apparently able to detect and enter thermals both near the ground and well above the ground. In addition, adults of both species are able to remain within thermals by soaring in circles. The presence of this highly specialized behaviour in members of two distinct families of butterflies (Danaidae and Nymphalidae) suggests that the ability to soar may be widespread among butterflies.

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Department of Zoology, Erindale College, University of Toronto, Mississauga, Ontario L5L 1C6, Canada.

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